EXHIBIT 1

US005817207A

United States Patent [19]

Leighton

[11] **Patent Number: 5,817,207**

[45] **Date of Patent: Oct. 6, 1998**

[54] **RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS**

[76] Inventor: **Keith R. Leighton**, 2817 Fulmer Rd., Lorain, Ohio 44053

[21] Appl. No.: **727,789**

[22] Filed: **Oct. 7, 1996**

Related U.S. Application Data

[60] Provisional application No. 60/005,685 Oct. 17, 1995.

[51] **Int. Cl.**[6] **B32B 31/20**

[52] **U.S. Cl.** **156/298**; 156/312

[58] **Field of Search** 156/300, 312, 156/311, 298

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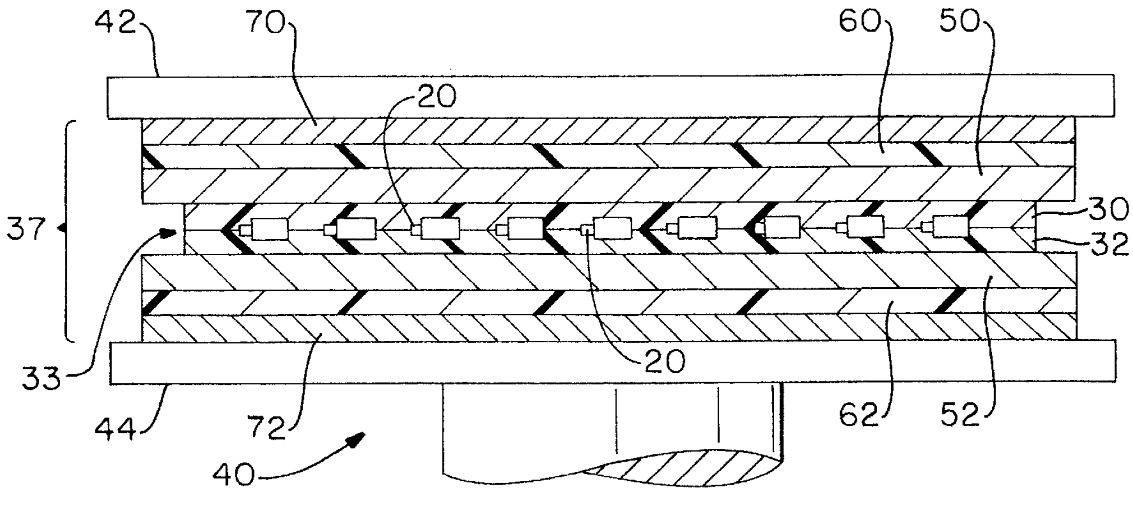
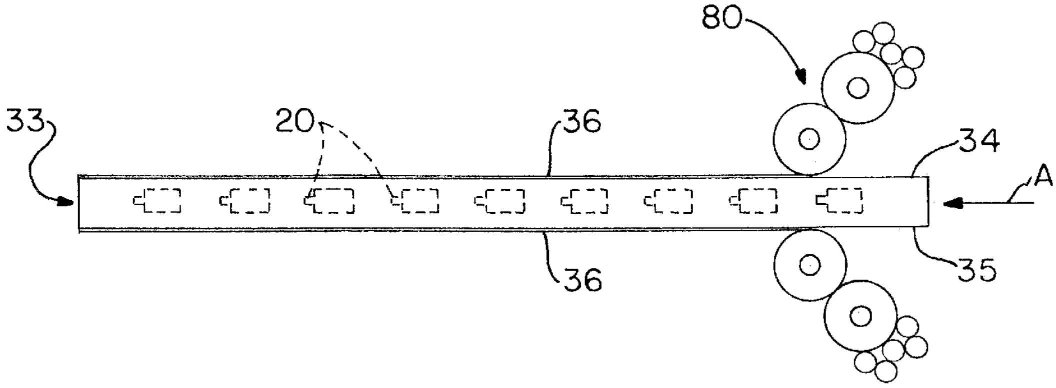
[57] **ABSTRACT**

A plastic card, such as a radio frequency identification card, including at least one electronic element embedded therein and a hot lamination process for the manufacture of radio frequency identification cards and other plastic cards including a micro-chip embedded therein. The process results in a card having an overall thickness in the range of 0.028 inches to 0.032 inches with a surface suitable for receiving dye sublimation printing—the variation in card thickness across the surface is less than 0.0005 inches. A card manufactured in accordance with the present invention also complies with all industry standards and specifications. Also, the hot lamination process of the present invention results in an aesthetically pleasing card. The invention also relates to a plastic card formed in accordance with the hot lamination process of the present invention.

17 Claims, 3 Drawing Sheets





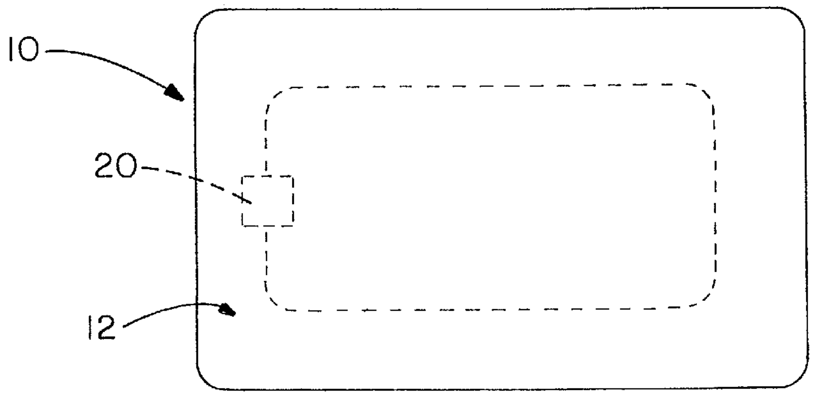


FIG.-1

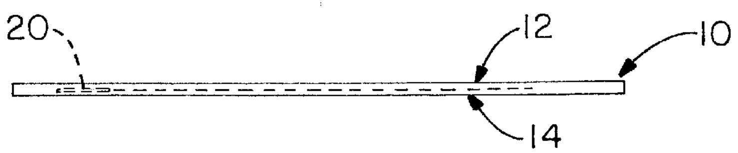


FIG.-2

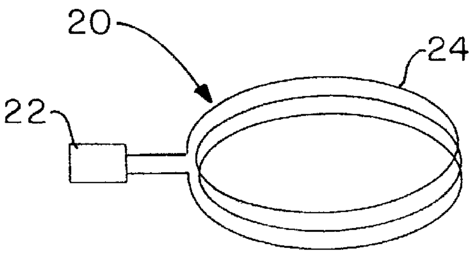


FIG.-3A

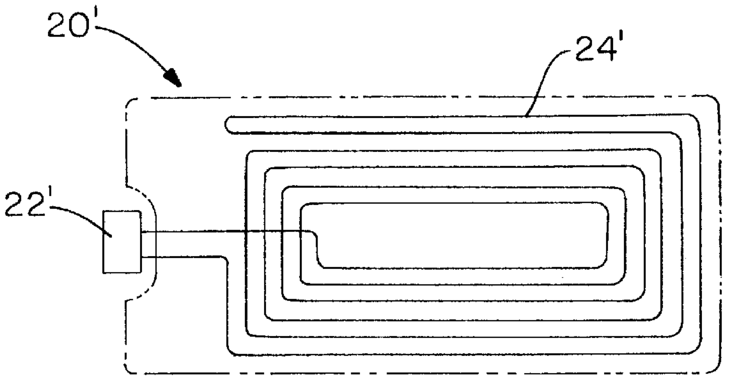


FIG.-3B

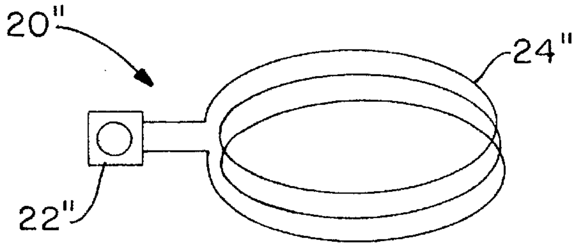


FIG.-3C

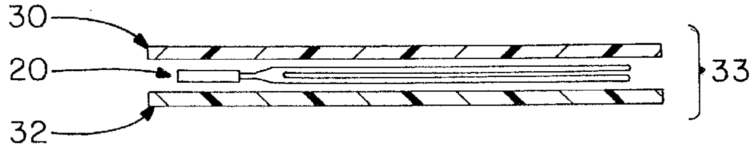


FIG.-4

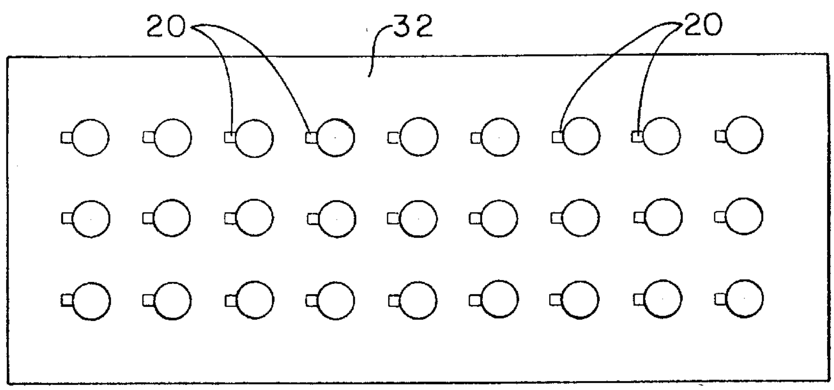


FIG.-5

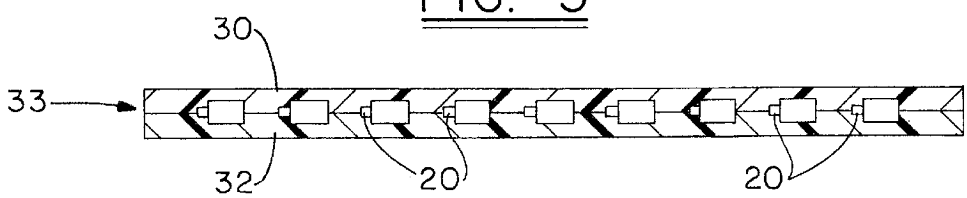


FIG.-6

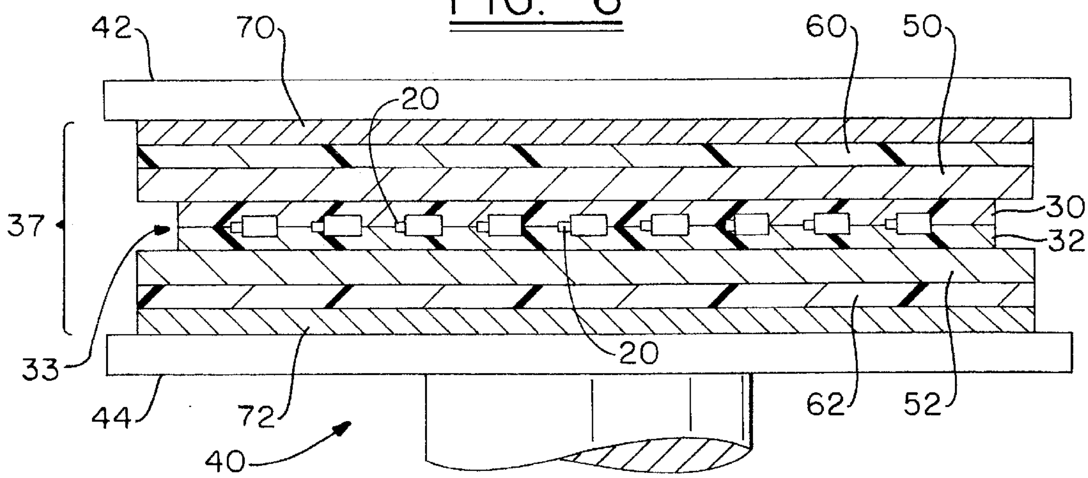


FIG.-7

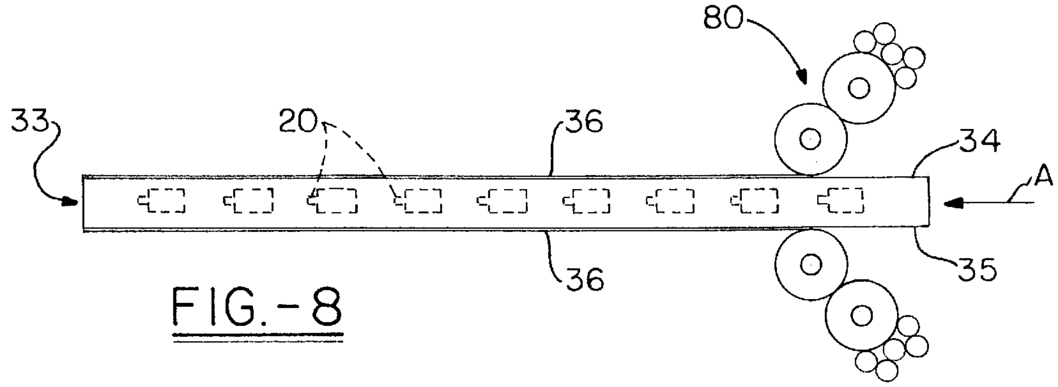


FIG.-8

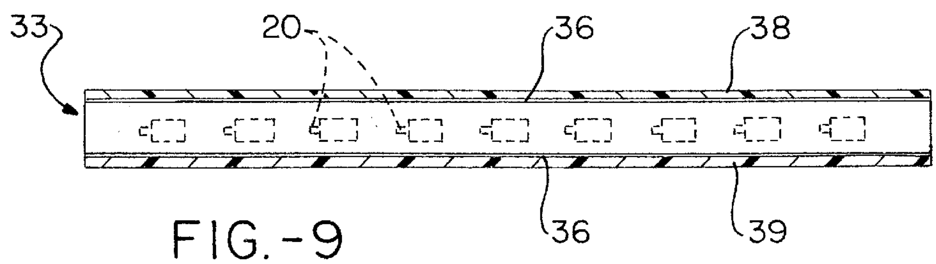


FIG.-9

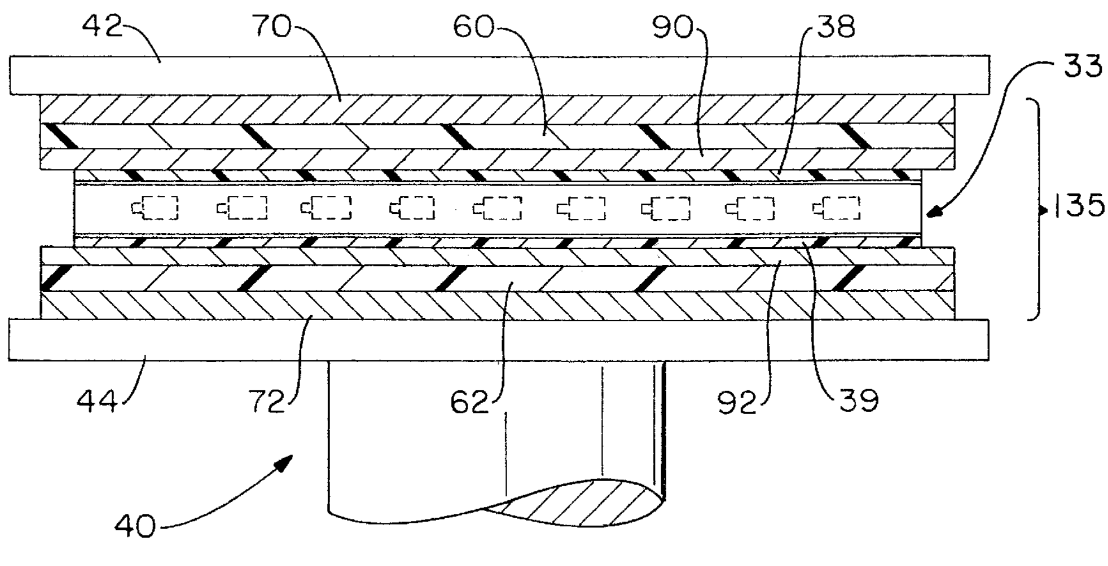


FIG.-10

RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

This application claims the benefit of the following: U.S. Provisional Application No.: 60/005,685, filing date Oct. 17, 1995.

FIELD OF THE INVENTION

The present invention relates generally to plastic cards and the manufacture thereof, and more particularly to radio frequency identification (RFID) cards and the manufacture of RFID cards that conform to industry size and performance standards and conventions and that have a superior outer surface to known RFID cards such that card may receive dye sublimation printing or the like.

BACKGROUND OF THE INVENTION

As the use of plastic cards for credit cards, automated teller machine (ATM) cards, identification cards, and like continues to become more widespread, the problems associated with the use of such cards correspondingly increase. Credit card fraud and identification card fraud are becoming larger problems everyday, and this fraud has introduced uncertainties into our systems of commerce and our security systems. Using easily available technology, criminals are able to manufacture credit/debit cards, ATM cards, identification cards, and the like having another's account code, identification code, or other personal information embedded in the magnetic stripe thereof. Thus, for example, criminals may steal hundreds or thousands of legitimate credit card account numbers and manufacture many additional cards bearing the stolen information. These fraudulent cards are then usable by the criminals to purchase goods and to receive cash with the legitimate card holder and the card issuer left holding the bill. Likewise, so called debit cards are becoming increasingly popular. These cards have stored thereon a certain amount of value for which the card owner has previously paid. For example, a subway rider may purchase a card good for 50 fares, with one fare being deducted from the card each time the owner rides the subway. Criminals have also been able to manipulate the data stored on these cards to defraud the merchants and others.

The ease in which criminals have been able to manufacture and or manipulate known cards results from the existence of the easily altered magnetic stripe storage medium used by known cards. These magnetic stripes are easily programmed and reprogrammed using commonly available technology. Thus, there has been found a need in the plastic card industry to provide a more secure plastic card that is very difficult or impossible to fraudulently manipulate. The most likely solution to the above-noted problems associated with known plastic cards is the RFID card and other cards including computer chips embedded therein rather than, or in addition to, a magnetic stripe. While these RFID cards and like have been found to be successful in preventing or limiting fraud, they are more difficult and expensive to manufacture relative to ordinary magnetic stripe cards. One of the biggest obstacles to the wide spread manufacture and use of RFID cards has been the inability of card manufacturers to manufacturer an RFID card that meets all industry standards and specifications, such as those set by the International Standards Organization (ISO), that are sufficiently aesthetically pleasing (wherein the embedded electronics are

hidden from view), and that have a sufficiently regular or flat surface such that one or both surfaces of the card may be printed on using the very popular and widespread dye sublimation technology. Known plastic cards with computer chips and like embedded therein are too thick to work in connection with existing card reading machinery (ATM machines, telephones, and like) and have a surface that is too irregular to properly and consistently receive dye sublimation printing. Furthermore, prior attempts to manufacture a sufficiently thin plastic card including a computer chip embedded therein have resulted in a card with inferior aesthetic qualities such as the ability to see the embedded computer chip through the plastic.

SUMMARY OF THE INVENTION

The present invention is therefore directed to a plastic card having at least one electronic element embedded therein and to a hot lamination method for the manufacture of plastic cards including at least one electronic element therein. The card has an overall thickness in the range of 0.028 inches to 0.032 inches and comprises a plastic core having at least one electronic element embedded therein with at least one of the upper and lower surfaces of the core comprising a coating printed or otherwise applied thereon. An overlaminate film is preferably provided over the coated surface of the core and the resulting card has a variation in thickness across the surfaces thereof of no greater than approximately 0.0005 inches. The hot lamination method of the present invention comprises the steps of providing first and second plastic core sheets, positioning at least one electronic element between the first and second core sheets to thus form a core, and placing the core in a laminator and closing the laminator without applying laminator ram pressure to the core. A heat cycle is applied to the core sheets in the laminator thus liquefying or partially liquefying the sheets. The laminator ram pressure is then increased in combination with the heat. A cooling cycle is then applied to the core in the laminator, preferably with an associated increase in ram pressure, and the core is removed from the laminator. At least one surface of the core is then printed on using a printing press or similar printing apparatus, a sheet of overlaminate film is placed on at least one side of the core, and the core is then again placed in a laminator. A heat cycle is applied to the core with its overlaminate film, and a cooling cycle is thereafter applied, resulting in a sheet of plastic card stock from which one or more cards may be cut. The invention is also directed to a card manufactured in accordance with the above process which results in a plastic card having a thickness in the range of approximately 0.028 inches to 0.032 inches with a surface smoothness of at least approximately 0.0005 inches as is required by ISO and American National Standards Institute (ANSI) standards.

The present invention provides numerous advantages over known plastic cards and known plastic card manufacturing processes, including the formation of a plastic card with electronic elements such as a computer chip embedded therein with a pleasing aesthetic appearance, with a sufficiently smooth and regular surface such that the card may receive dye sublimation printing, and with sufficient durability and characteristics to comply with all industry specifications and standards.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of a plastic card in accordance with the present invention;

FIG. **2** is a side elevational view of the card shown in FIG. **1**;

FIGS. **3A–3C** are top plan views of various electronic elements that may be embedded in a card in accordance with the present invention;

FIG. **4** is an exploded, schematic view of an electronic element position between two plastic core sheets to form a core;

FIG. **5** is a top plan view of a plurality of electronic elements positioned on a sheet of plastic core stock such that they may be covered by a similar sheet of core stock;

FIG. **6** is a schematic cross-sectional view of one or more electronic elements positioned between sheets of plastic core stock;

FIG. **7** schematically illustrates a book comprising the core, as it is positioned in a laminator apparatus;

FIG. **8** schematically illustrates the core as it is being printed on after removal from the laminator using a printing press or similar printing apparatus;

FIG. **9** is a cross-sectional view schematically illustrating the application of an overlaminate film to at least one side of the core;

FIG. **10** schematically illustrates the core with overlaminate film, as it is placed in a laminator for final processing to form a sheet of card stock.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a plastic card including at least one electronic element embedded therein. The present invention also relates to a hot lamination process for the manufacture of plastic cards, and more particularly to a hot lamination process for the manufacturer of plastic cards that include an electronic element, such as a computer chip or other electronic element embedded therein. The electronic element may perform a wide variety of functions and take a wide variety of forms. Such cards, without regard to the particular electronic element embedded therein, will hereinafter be referred to as radio frequency identification (RFID) cards. The present invention also relates to a card formed in accordance with the invention.

Referring now to FIG. **1**, there can be seen a plastic RFID card **10** manufactured in accordance with the present invention and including an electronic element **20** embedded therein. Card **10** includes an upper surface **12** and a lower surface **14**. Electronic element **20** may take a wide variety of forms and perform a wide variety of functions. As shown in FIG. **3A–3C** respectively, electronic element **20, 20', 20"** may be provided by a micro-chip **22** including a wire antenna **24** connected thereto, a micro-chip **22'** and a circuit board antenna **24'**, a read/write micro-chip **22"** and a wire coil antenna **24"**, or any other suitable electronic element. These electronic elements **20, 20', 20"** and their insertion into plastic cards is not new, however, the present invention provides a new hot lamination process for manufacturing plastic cards **10** with these electronic elements **20, 20', 20"** embedded therein such that the cards **10** are of a superior quality, such that the cards **10** meet all ISO and other industry specifications and standards, in such that at least one of the upper and lower surfaces **12, 14** of card **10** is sufficiently smooth and is otherwise is capable of receiving dye sublimation printing. Specifically, a card in accordance with the present invention has a thickness of approximately in the range of 0.028 inches to 0.032 inches with a surface smoothness of 0.0005 inches.

As shown in FIGS. **4–10** one or more cards **10** in accordance with the present invention may be manufactured by positioning an electronic element **20** between first and second sheets of card stock **30, 32** to form a core **33**. Preferably is shown in FIG. **5–10**, a plurality of cards are manufactured simultaneously, in thus, a plurality of electronic elements **20** are positioned between the first and second sheets of plastic core stock **30, 32** (only the second sheet **32** begin shown in FIG. **5** for clarity). When a plurality of electronic elements **20** are positioned between first and second sheets plastic core stock **30, 32,** electronic elements **20** are properly positioned relative to one another such that a plurality cards may be cut from the resulting card stock. Plastic core sheets **30, 32** may be provided by a wide variety of plastics, the preferred being polyvinyl chloride (PVC) having a thickness in the range of 0.007 inches to 0.024 inches and preferably having a thickness of approximately 0.0125 inches each. Those skilled in the art will recognize that the thickness of the plastic core sheets will depend upon the thickness of the one or more electronic elements that are to be embedded therebetween. Other suitable plastics that may be utilized include polyester, acrylonitrile-butadiene-styrene (ABS), and any other suitable plastic.

Subsequent to placing one or more electronic elements **20** between the first and second sheets **30, 32** of plastic core stock to form a core **33**, this core **33** is placed in a laminator apparatus **40** of the type well known in the art of plastic card manufacturing. As is shown in FIG. **7**, laminator **40** includes upper and lower platens **42,44** for applying ram pressure to an article positioned therebetween. In addition to the ability to apply ram pressure, laminator **40** is preferably of the type having controlled platens **42,44** that may provide both heat and chill cycles and preferably includes cycle timer to regulate cycle time. Core **33** is positioned between first and second laminating plates **50, 52**, one of which is preferably matte finished to provide laminated core **33** with at least one textured outer surface. First and second laminating pads **60, 62** are positioned outside of the laminating plates **50, 52,** and first and second steel plates **70, 72** are likewise positioned outside of pads of **60, 62** and the entire assembly forms a book **35** for being positioned in laminator **40** between platens **42, 44.**

Once book **35** is positioned in laminator **40** as shown in FIG. **7**, the first lamination cycle is initiated by closing laminator platens **42, 44,** preferably applying little or no ram pressure to book **35**. A laminator heat cycle is initiated, bringing the temperature of platens **42,44** up to a range of 275° F. to 400° F., and most preferably up to a range of 300° F. to 370° F. for a period of greater than 5 minutes, and preferably in the range of 7 to 10 minutes. Once the heat cycle has been applied to the book **35** as is set forth above, the ram pressure of laminator **40** is increased to facilitate the flow of the plastic core sheets **30, 32** so that the one or more electronic elements **20** are encapsulated there by, and so that sheets **30, 32** form a uniform core **33** (seen most clearly in FIGS. **8–10**) with upper and lower surfaces **34,35**. As mentioned, the use of matte finished laminator plates **50,52** provides surfaces **34,35** with a slightly roughened or textured quality which will facilitate the application of a coating thereto as is discussed below. The ram pressure applied during the heat cycle and the length of the heat cycle may vary, depending especially upon the size of sheets **30, 32**. For example, the cycle time may be in the range of 10–15 minutes. In one example, a ram pressure of 940.135 pounds per square inch (p.s.i.) was applied for 10–15 minutes to form a uniform core **33**, using sheets **30,32** of a size in the range of 12 inches by 24 inches to 24 inches by 36 inches.

Subsequent to the above heat cycle, laminator **40** applies a chill cycle to book **35** during which time the ram pressure

of the laminator **40** is increased, preferably by approximately 25% until the platens **42**,**44** have cooled to approximately 40° F. to 65° F. for approximately 10–15 minutes. Core **33** may then be removed from laminator **40** for additional processing.

Subsequent to the removal of core **33** from laminator **40**, and as illustrated in FIG. **8**, core **33** is coated on at least one of it's upper and lower surfaces **34**, **35** with a layer of printing ink **36**. This may be accomplished using a wide variety of printing techniques such as offset printing, letterpress printing, screen printing, roller coating, spray printing, litho-printing, and other suitable printing techniques. As shown in FIG. **8**, core **33** is fed in the direction indicated with arrow A through a printing press, a lithographic printer, or a similar apparatus **80**. This printing step is performed to coat at least one surface **34**, **35** of core **33** with a layer of aesthetically pleasing ink **36**. This layer of ink **36** cosmetically hides the one or more electronic elements **20** that are embedded within core **33**, and prevents these one or more electronic elements **20** from showing through the relatively thin core **33**. In this manner, the one or more electronic elements **20** encapsulated in core **33** are completely hidden from view without requiring the plastic used in the manufacture core **33** to be excessively thick.

Referring now to FIGS. **9**–**10**, the final processing of core **33**, which now comprises a layer of ink **36** or the like on at least one surface **34**,**35** thereof, is schematically illustrated. A layer of overlaminate film such as clear overlaminate film **38**,**39** is positioned on at least one ink coated surface **34**,**35** of core **33**, and preferably core **33** is positioned between two similar sheets of overlaminate film **38**,**39** as shown. Overlaminate film is very thin, for example in the range of 0.0015" thick. A book **135** is then constructed for insertion into laminator **40** as is schematically illustrated FIG. **10**. Book **135** comprising core **33**, including at least one layer of ink **36** and at least one layer of overlaminate film **38**, **39** is positioned between laminating plates which are preferably highly polished plates such as mirror finished stainless steel plates **90**, **92**. Book **135** also comprises first and second laminating pads **60**, **62** and first and second steel plates **70**, **72** as is discussed above in relation to FIG. **7**.

When book **135** is positioned between upper and lower platens **42**,**44** of laminator **40** as shown in FIG. **10**, the laminator is closed and a heat cycle in the range of 175° F. to 300° F., and most preferably in the range of 180° F. to 275° F., is applied to book **135** for a period of 10 to 25 minutes with a ram pressure that varies depending upon sheet size or the ram size of the laminator **40**, but which is typically approximately 1000 p.s.i. with an 18 inch diameter ram. The laminator **40** is then caused to execute a chill cycle, preferably with a corresponding increase in ram pressure. For example, the chill temperature may be in the range of 40° F. to 65° F. and last for a period of 10 to 25 minutes. A ram pressure increase of approximately 25% over the pressure used for the heat cycle has been found to be most preferable.

Subsequent to the above described second lamination cycle as illustrated in FIG. **10**, a sheet of plastic card stock is provided which comprises at least core **33** with at least one surface **34**,**35** thereof covered by a layer of ink **36**, and with at least one surface **34**,**35** thereof covered by a layer of overlaminate film **38**, **39**. Preferably plastic card stock manufactured in accordance with the present invention comprises core **33** covered on both surfaces **34**,**35** with a layer of ink **36** which is positioned between layers of overlaminate film **38**,**39**, all of which has been laminated together as described. One or more cards **10** then may be cut from the resulting plastic card stock and card **10** will have a thickness in the range of 0.028 inches to 0.032 inches with variation in overall thickness across the surfaces **12**, **14** thereof being no greater than approximately 0.0005 inches. The one or more cards **10** can thus be said to have a surface smoothness of approximately 0.0005 inches or better. Thus, a card **10** manufactured in accordance with the present invention includes at least one surface **12**,**14** at preferably both surfaces **12**,**14** that are sufficiently smooth and regular to receive dye sublimation printing.

Those skilled in the art will recognize that the foregoing description has set forth the preferred embodiment of the invention in particular detail and it must be understood that numerous modifications, substitutions, and changes may be undertaken without departing from the true spirit and scope of the present invention as defined by the ensuing claims.

What is claimed is:

1. A process for incorporating at least one electronic element in the manufacture of a plastic card, comprising the steps of:

(a) providing first and second plastic core sheets;

(b) positioning said at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a core, said plastic core sheets defining a pair of inner and outer surfaces of said core;

(c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:

(i) heating said core for a first period of time;

(ii) applying a first pressure to said core for a second period of time such that said at least one electronic element is encapsulated by said core;

(iii) cooling said core while applying a second pressure to said core,

(d) coating at least one of said outer surfaces of said core with a layer of ink; and

(e) applying a layer of overlaminate film to at least one of said outer surfaces of said core.

2. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said laminator apparatus has first and second laminating plates, at least one of said first and second laminating plates having a matte finish for creating a textured surface on at least one of said outer surfaces of said core.

3. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **2**, wherein each of said first and second laminating plates has a matte finish for creating said textured surface on both of said outer surfaces of said core.

4. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said first and second plastic core sheets are made from a material selected from the group consisting of polyvinyl chloride, polyester, and acrylonitrile-butadiene-styrene, each of said sheets having a thickness in the range of 0.007 to 0.024 inch.

5. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **4**, wherein said first and second plastic core sheets have a thickness of approximately 0.0125 inch.

6. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said second pressure is greater than said first pressure.

7. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **6**, wherein said second pressure is at least approximately 25% greater than said first pressure.

8. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said core is heated in step (c)(i) to a temperature in the range of 275° F. to 400° F. and said first period of time is at least five (5) minutes.

9. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said first pressure is approximately 1000 p.s.i. and said second period of time is at least 10 minutes.

10. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said step (d) is carried out utilizing a printing press.

11. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said step (d) is carried out utilizing a coating technique selected form the group consisting of silk screen printing, offset printing, letterpress printing, screen printing, roller coating, spray printing, and litho-printing.

12. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said step (e) of applying a layer of overlaminate film comprises the further steps of:

(a) positioning an overlaminate film on at least one ink coated surface of said core;

(b) subjecting said core to a second heat and pressure cycle comprising the steps of:

(i) heating said core to a temperature between approximately 175° F. to 300° F. for approximately 10 to 25 minutes;

(ii) applying approximately 1000 p.s.i. pressure to said core; and

(iii) cooling said core to a temperature in the range of approximately 40° F. to 65° F. for approximately 10 to 25 minutes.

13. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said at least one electronic element is a micro-chip and an associated wire antenna.

14. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said at least one electronic element is a micro-chip and an associated circuit board antenna.

15. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said at least one electronic element is a read/write integrated chip and an associated antenna.

16. A hot lamination process for the manufacture of plastic cards, said process comprising the steps of:

(a) providing first and second plastic core sheets;

(b) positioning at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a layered core;

(c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:

(i) heating said core in said laminator, in the presence of a minimal first ram pressure, to a temperature which causes controlled flow of said plastic which makes up said first and second plastic core sheets;

(ii) applying a second pressure uniformly across said core for encapsulating said at least one electronic element within said controlled flow plastic;

(iii) subsequently cooling said core in conjunction with the concurrent application of a third pressure uniformly across said core, said core including and upper and lower surfaces;

(d) printing on at least one of said upper and lower surfaces of said core such that a layer of ink is applied to at least a portion of said at least one upper and lower surface of said core.

17. The method as recited in claim **16** wherein said first and second core layers are devoid of any appreciable cut-outs.

* * * * *

EXHIBIT 2

US006214155B1

(12) **United States Patent**
Leighton

(10) **Patent No.: US 6,214,155 B1**
(45) **Date of Patent: Apr. 10, 2001**

(54) **RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/158,290**

(22) Filed: **Sep. 22, 1998**

Related U.S. Application Data

(63) Continuation of application No. 08/727,789, filed on Oct. 7, 1996, now Pat. No. 5,817,207.

(60) Provisional application No. 60/005,685, filed on Oct. 17, 1995.

(51) **Int. Cl.**[7] **B32B 31/20**

(52) **U.S. Cl.** **156/298**; 156/312

(58) **Field of Search** 156/298, 312

(56) **References Cited**

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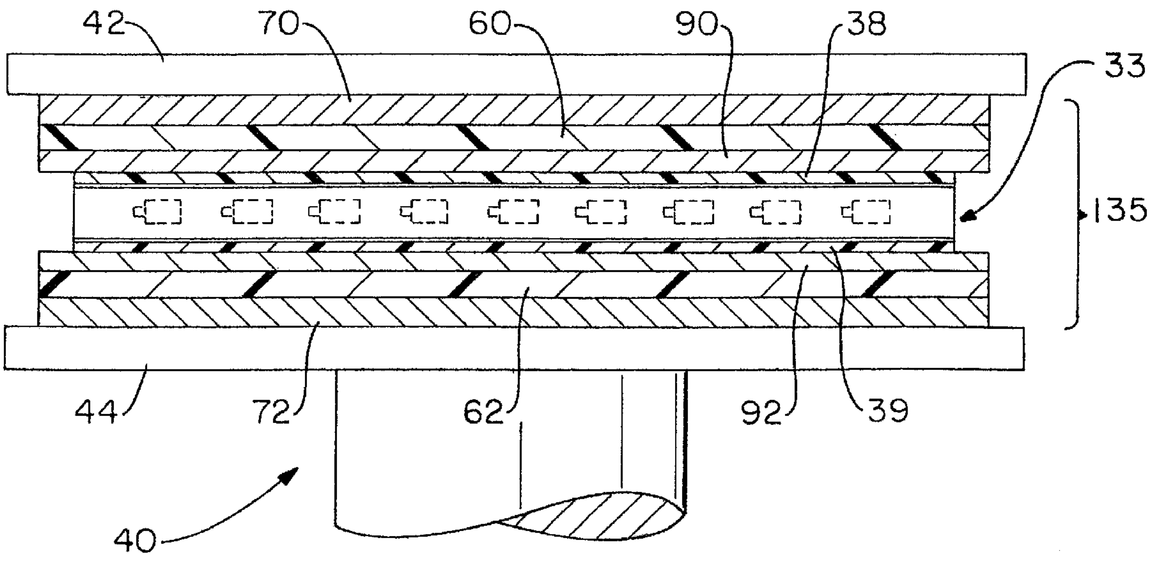
(57) **ABSTRACT**

A plastic card, such as a radio frequency identification card, including at least one electronic element embedded therein and a hot lamination process for the manufacture of radio frequency identification cards and other plastic cards including a micro-chip embedded therein. The process results in a card having an overall thickness in the range of 0.028 inches to 0.032 inches with a surface suitable for receiving dye sublimation printing—the variation in card thickness across the surface is less than 0.0005 inches. A card manufactured in accordance with the present invention also complies with all industry standards and specifications. Also, the hot lamination process of the present invention results in an aesthetically pleasing card. The invention also relates to a plastic card formed in accordance with the hot lamination process of the present invention.

16 Claims, 3 Drawing Sheets



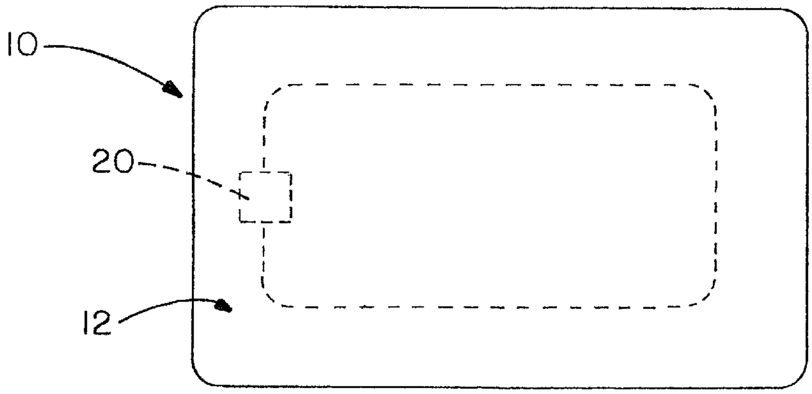


FIG.-1

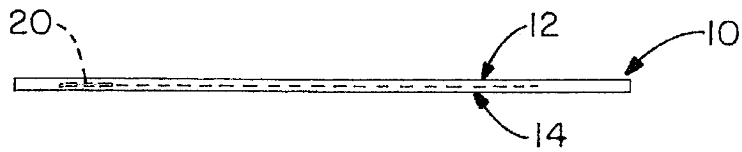


FIG.-2

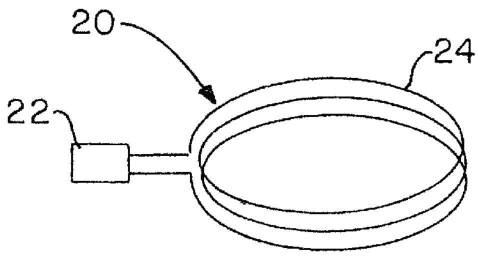


FIG.-3A

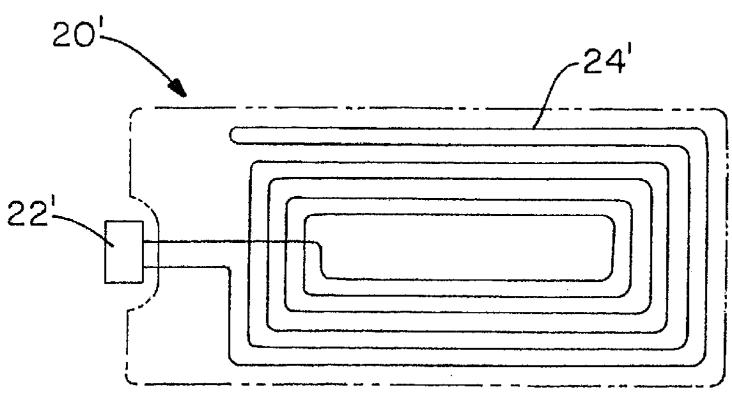


FIG.-3B

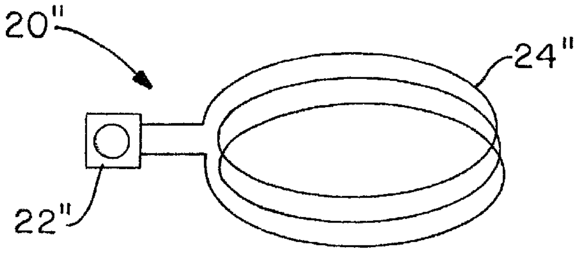


FIG.-3C

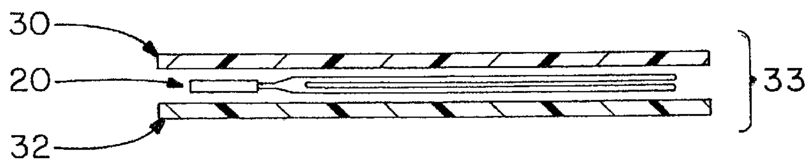


FIG.-4

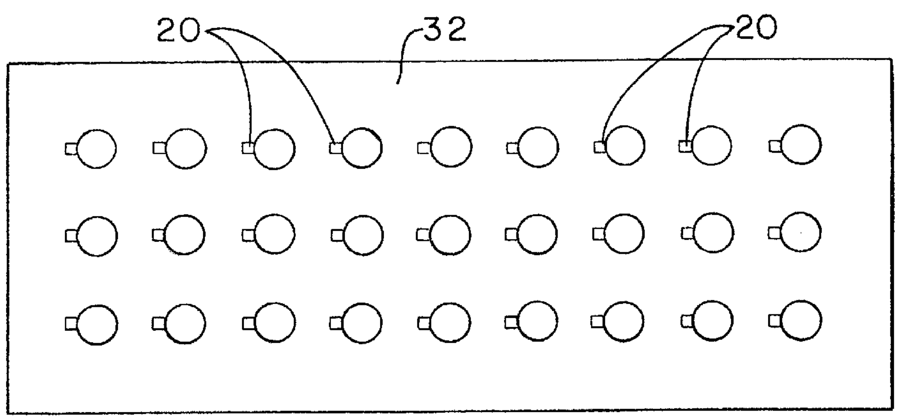


FIG.-5

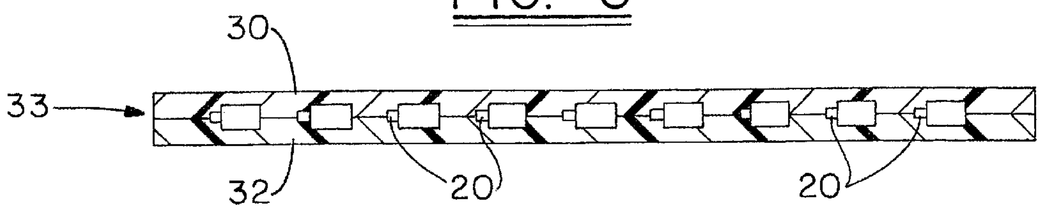


FIG.-6

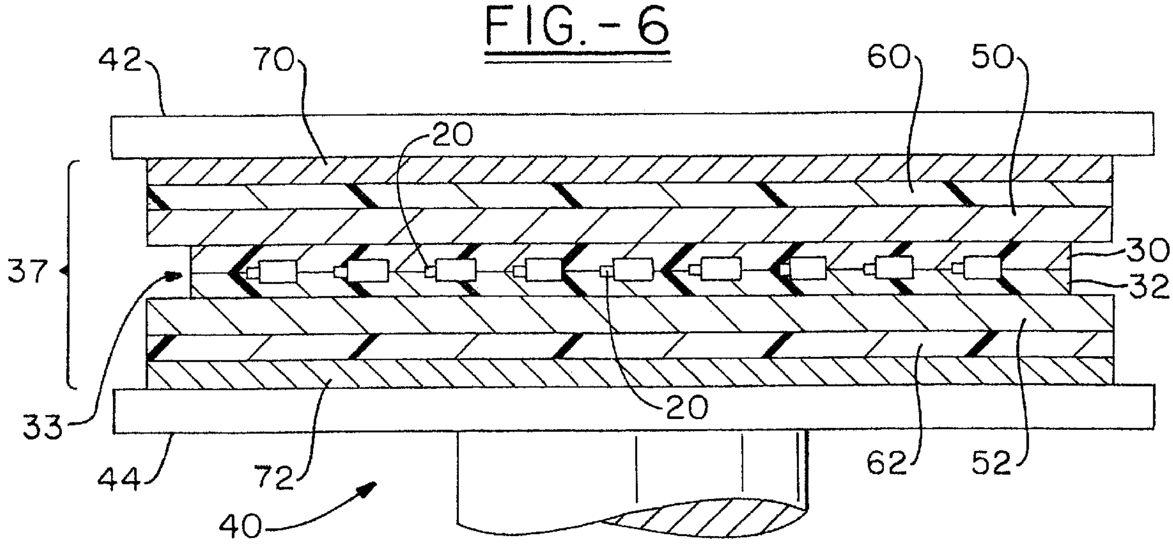


FIG.-7

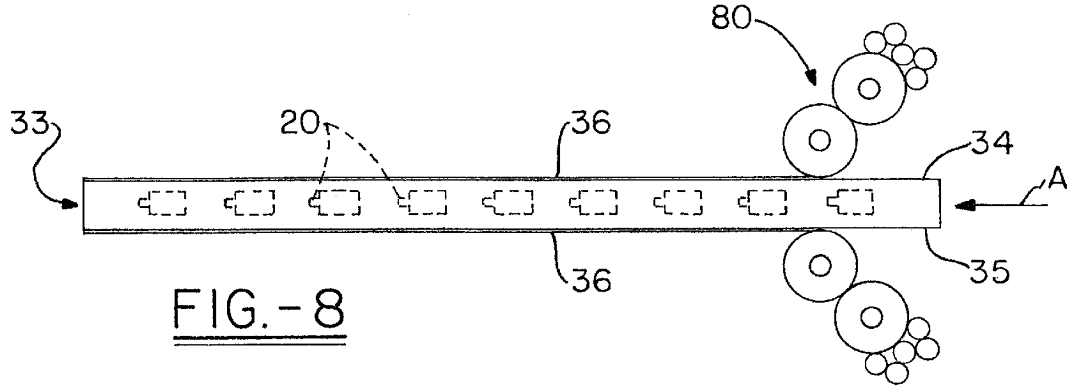


FIG.-8

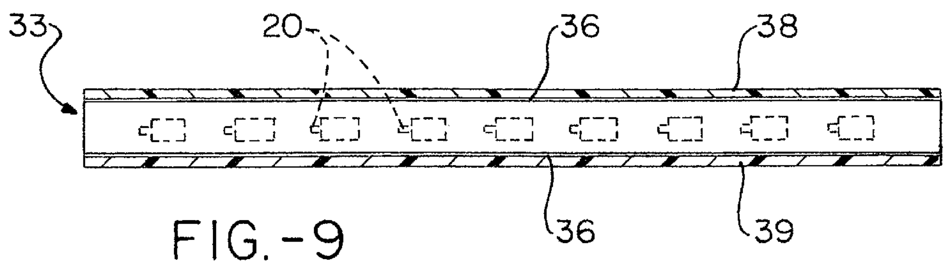


FIG.-9

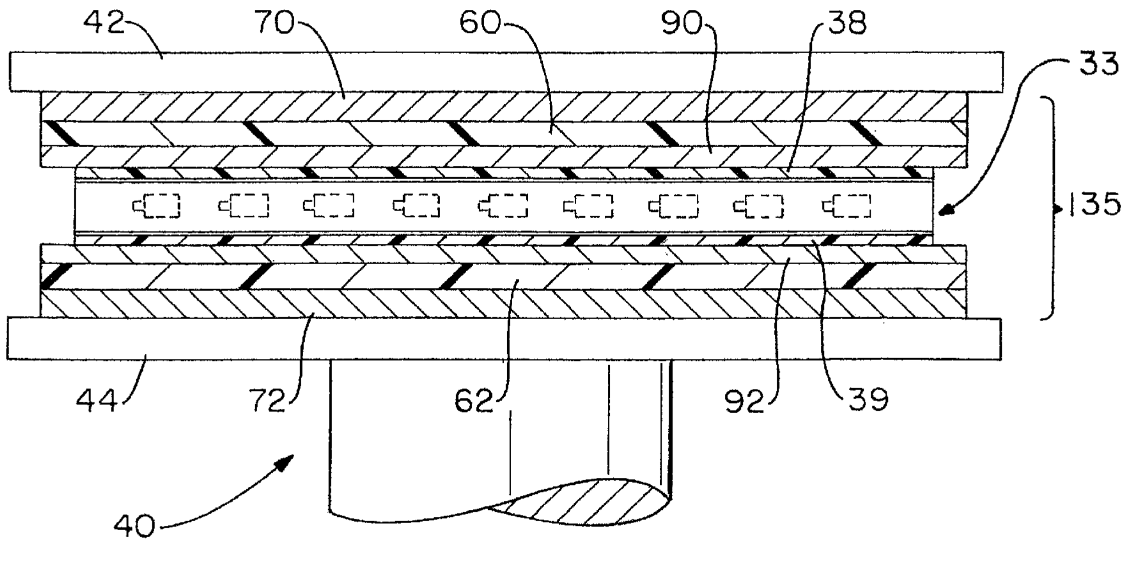


FIG.-10

RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

This application is a continuation of Ser. No. 08/727,789, now U.S. Pat. No. 5,817,207 which claim the benefit of provision of application 60/005,685 filed on Oct. 17, 1995.

FIELD OF THE INVENTION

The present invention relates generally to plastic cards and the manufacture thereof, and more particularly to radio frequency identification (RFID) cards and the manufacture of RFID cards that conform to industry size and performance standards and conventions and that have a superior outer surface to known RFID cards such that card may receive dye sublimation printing or the like.

BACKGROUND OF THE INVENTION

As the use of plastic cards for credit cards, automated teller machine (ATM) cards, identification cards, and like continues to become more widespread, the problems associated with the use of such cards correspondingly increase. Credit card fraud and identification card fraud are becoming larger problems everyday, and this fraud has introduced uncertainties into our systems of commerce and our security systems. Using easily available technology, criminals are able to manufacture credit/debit cards, ATM cards, identification cards, and the like having another's account code, identification code, or other personal information embedded in the magnetic stripe thereof. Thus, for example, criminals may steal hundreds or thousands of legitimate credit card account numbers and manufacture many additional cards bearing the stolen information. These fraudulent cards are then usable by the criminals to purchase goods and to receive cash with the legitimate card holder and the card issuer left holding the bill. Likewise, so called debit cards are becoming increasingly popular. These cards have stored thereon a certain amount of value for which the card owner has previously paid. For example, a subway rider may purchase a card good for 50 fares, with one fare being deducted from the card each time the owner rides the subway. Criminals have also been able to manipulate the data stored on these cards to defraud the merchants and others.

The ease in which criminals have been able to manufacture and or manipulate known cards results from the existence of the easily altered magnetic stripe storage medium used by known cards. These magnetic stripes are easily programmed and reprogrammed using commonly available technology. Thus, there has been found a need in the plastic card industry to provide a more secure plastic card that is very difficult or impossible to fraudulently manipulate. The most likely solution to the above-noted problems associated with known plastic cards is the RFID card and other cards including computer chips embedded therein rather than, or in addition to, a magnetic stripe. While these RFID cards and like have been found to be successful in preventing or limiting fraud, they are more difficult and expensive to manufacture relative to ordinary magnetic stripe cards. One of the biggest obstacles to the wide spread manufacture and use of RFID cards has been the inability of card manufacturers to manufacturer an RFID card that meets all industry standards and specifications, such as those set by the International Standards Organization (ISO), that are sufficiently aesthetically pleasing (wherein the embedded electronics are

hidden from view), and that have a sufficiently regular or flat surface such that one or both surfaces of the card may be printed on using the very popular and widespread dye sublimation technology. Known plastic cards with computer chips and like embedded therein are too thick to work in connection with existing card reading machinery (ATM machines, telephones, and like) and have a surface that is too irregular to properly and consistently receive dye sublimation printing. Furthermore, prior attempts to manufacture a sufficiently thin plastic card including a computer chip embedded therein have resulted in a card with inferior aesthetic qualities such as the ability to see the embedded computer chip through the plastic.

SUMMARY OF THE INVENTION

The present invention is therefore directed to a plastic card having at least one electronic element embedded therein and to a hot lamination method for the manufacture of plastic cards including at least one electronic element therein. The card has an overall thickness in the range of 0.028 inches to 0.032 inches and comprises a plastic core having at least one electronic element embedded therein with at least one of the upper and lower surfaces of the core comprising a coating printed or otherwise applied thereon. An overlaminate film is preferably provided over the coated surface of the core and the resulting card has a variation in thickness across the surfaces thereof of no greater than approximately 0.0005 inches. The hot lamination method of the present invention comprises the steps of providing first and second plastic core sheets, positioning at least one electronic element between the first and second core sheets to thus form a core, and placing the core in a laminator and closing the laminator without applying laminator ram pressure to the core. A heat cycle is applied to the core sheets in the laminator thus liquefying or partially liquefying the sheets. The laminator ram pressure is then increased in combination with the heat. A cooling cycle is then applied to the core in the laminator, preferably with an associated increase in ram pressure, and the core is removed from the laminator. At least one surface of the core is then printed on using a printing press or similar printing apparatus, a sheet of overlaminate film is placed on at least one side of the core, and the core is then again placed in a laminator. A heat cycle is applied to the core with its overlaminate film, and a cooling cycle is thereafter applied, resulting in a sheet of plastic card stock from which one or more cards may be cut. The invention is also directed to a card manufactured in accordance with the above process which results in a plastic card having a thickness in the range of approximately 0.028 inches to 0.032 inches with a surface smoothness of at least approximately 0.0005 inches as is required by ISO and American National Standards Institute (ANSI) standards.

The present invention provides numerous advantages over known plastic cards and known plastic card manufacturing processes, including the formation of a plastic card with electronic elements such as a computer chip embedded therein with a pleasing aesthetic appearance, with a sufficiently smooth and regular surface such that the card may receive dye sublimation printing, and with sufficient durability and characteristics to comply with all industry specifications and standards.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of a plastic card in accordance with the present invention;

FIG. **2** is a side elevational view of the card shown in FIG. **1**;

FIGS. **3A–3C** are top plan views of various electronic elements that may be embedded in a card in accordance with the present invention;

FIG. **4** is an exploded, schematic view of an electronic element position between two plastic core sheets to form a core;

FIG. **5** is a top plan view of a plurality of electronic elements positioned on a sheet of plastic core stock such that they may be covered by a similar sheet of core stock;

FIG. **6** is a schematic cross-sectional view of one or more electronic elements positioned between sheets of plastic core stock;

FIG. **7** schematically illustrates a book comprising the core, as it is positioned in a laminator apparatus;

FIG. **8** schematically illustrates the core as it is being printed on after removal from the laminator using a printing press or similar printing apparatus;

FIG. **9** is a cross-sectional view schematically illustrating the application of an overlaminate film to at least one side of the core;

FIG. **10** schematically illustrates the core with overlaminate film, as it is placed in a laminator for final processing to form a sheet of card stock.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a plastic card including at least one electronic element embedded therein. The present invention also relates to a hot lamination process for the manufacture of plastic cards, and more particularly to a hot lamination process for the manufacturer of plastic cards that include an electronic element, such as a computer chip or other electronic element embedded therein. The electronic element may perform a wide variety of functions and take a wide variety of forms. Such cards, without regard to the particular electronic element embedded therein, will hereinafter be referred to as radio frequency identification (RFID) cards. The present invention also relates to a card formed in accordance with the invention.

Referring now to FIG. **1**, there can be seen a plastic RFID card **10** manufactured in accordance with the present invention and including an electronic element **20** embedded therein. Card **10** includes an upper surface **12** and a lower surface **14**. Electronic element **20** may take a wide variety of forms and perform a wide variety of functions. As shown in FIGS. **3A–3C** respectively, electronic element **20, 20', 20"** may be provided by a micro-chip **22** including a wire antenna **24** connected thereto, a micro-chip **22'** and a circuit board antenna **24'**, a read/write micro-chip **22"** and a wire coil antenna **24"**, or any other suitable electronic element. These electronic elements **20, 20', 20"** and their insertion into plastic cards is not new, however, the present invention provides a new hot lamination process for manufacturing plastic cards **10** with these electronic elements **20, 20', 20"** embedded therein such that the cards **10** are of a superior quality, such that the cards **10** meet all ISO and other industry specifications and standards, in such that at least one of the upper and lower surfaces **12, 14** of card **10** is sufficiently smooth and is otherwise is capable of receiving dye sublimation printing. Specifically, a card in accordance with the present invention has a thickness of approximately in the range of 0.028 inches to 0.032 inches with a surface smoothness of 0.0005 inches.

As shown in FIGS. **4–10** one or more cards **10** in accordance with the present invention may be manufactured by positioning an electronic element **20** between first and second sheets of card stock **30, 32** to form a core **33**. Preferably is shown in FIGS. **5–10**, a plurality of cards are manufactured simultaneously, in thus, a plurality of electronic elements **20** are positioned between the first and second sheets of plastic core stock **30, 32** (only the second sheet **32** begin shown in FIG. **5** for clarity). When a plurality of electronic elements **20** are positioned between first and second sheets plastic core stock **30, 32**, electronic elements **20** are properly positioned relative to one another such that a plurality cards may be cut from the resulting card stock. Plastic core sheets **30, 32** may be provided by a wide variety of plastics, the preferred being polyvinyl chloride (PVC) having a thickness in the range of 0.007 inches to 0.024 inches and preferably having a thickness of approximately 0.0125 inches each. Those skilled in the art will recognize that the thickness of the plastic core sheets will depend upon the thickness of the one or more electronic elements that are to be embedded therebetween. Other suitable plastics that may be utilized include polyester, acrylonitrile-butadiene-styrene (ABS), and any other suitable plastic.

Subsequent to placing one or more electronic elements **20** between the first and second sheets **30, 32** of plastic core stock to form a core **33**, this core **33** is placed in a laminator apparatus **40** of the type well known in the art of plastic card manufacturing. As is shown in FIG. **7**, laminator **40** includes upper and lower platens **42, 44** for applying ram pressure to an article positioned therebetween. In addition to the ability to apply ram pressure, laminator **40** is preferably of the type having controlled platens **42, 44** that may provide both heat and chill cycles and preferably includes cycle timer to regulate cycle time. Core **33** is positioned between first and second laminating plates **50, 52**, one of which is preferably matte finished to provide laminated core **33** with at least one textured outer surface. First and second laminating pads **60, 62** are positioned outside of the laminating plates **50, 52**, and first and second steel plates **70, 72** are likewise positioned outside of pads of **60, 62** and the entire assembly forms a book **35** for being positioned in laminator **40** between platens **42, 44**.

Once book **35** is positioned in laminator **40** as shown in FIG. **7**, the first lamination cycle is initiated by closing laminator platens **42, 44**, preferably applying little or no ram pressure to book **35**. A laminator heat cycle is initiated, bringing the temperature of platens **42,44** up to a range of 275° F. to 400° F., and most preferably up to a range of 300° F. to 370° F. for a period of greater than 5 minutes, and preferably in the range of 7 to 10 minutes. Once the heat cycle has been applied to the book **35** as is set forth above, the ram pressure of laminator **40** is increased to facilitate the flow of the plastic core sheets **30, 32** so that the one or more electronic elements **20** are encapsulated there by, and so that sheets **30, 32** form a uniform core **33** (seen most clearly in FIGS. **8–10**) with upper and lower surfaces **34, 35**. As mentioned, the use of matte finished laminator plates **50, 52** provides surfaces **34, 35** with a slightly roughened or textured quality which will facilitate the application of a coating thereto as is discussed below. The ram pressure applied during the heat cycle and the length of the heat cycle may vary, depending especially upon the size of sheets **30, 32**. For example, the cycle time may be in the range of 10–15 minutes. In one example, a ram pressure of 940.135 pounds per square inch (p.s.i.) was applied for 10–15 minutes to form a uniform core **33**, using sheets **30, 32** of a size in the range of 12 inches by 24 inches to 24 inches by 36 inches.

Subsequent to the above heat cycle, laminator **40** applies a chill cycle to book **35** during which time the ram pressure

of the laminator **40** is increased, preferably by approximately 25% until the platens **42**, **44** have cooled to approximately 40° F. to 65° F. for approximately 10–15 minutes. Core **33** may then be removed from laminator **40** for additional processing.

Subsequent to the removal of core **33** from laminator **40**, and as illustrated in FIG. **8**, core **33** is coated on at least one of it's upper and lower surfaces **34**, **35** with a layer of printing ink **36**. This may be accomplished using a wide variety of printing techniques such as offset printing, letterpress printing, screen printing, roller coating, spray printing, litho-printing, and other suitable printing techniques. As shown in FIG. **8**, core **33** is fed in the direction indicated with arrow A through a printing press, a lithographic printer, or a similar apparatus **80**. This printing step is performed to coat at least one surface **34**, **35** of core **33** with a layer of aesthetically pleasing ink **36**. This layer of ink **36** cosmetically hides the one or more electronic elements **20** that are embedded within core **33**, and prevents these one or more electronic elements **20** from showing through the relatively thin core **33**. In this manner, the one or more electronic elements **20** encapsulated in core **33** are completely hidden from view without requiring the plastic used in the manufacture core **33** to be excessively thick.

Referring now to FIGS. 9–10, the final processing of core **33**, which now comprises a layer of ink **36** or the like on at least one surface **34**, **35** thereof, is schematically illustrated. A layer of overlaminate film such as clear overlaminate film **38**, **39** is positioned on at least one ink coated surface **34**, **35** of core **33**, and preferably core **33** is positioned between two similar sheets of overlaminate film **38**, **39** as shown. Overlaminate film is very thin, for example in the range of 0.0015" thick. A book **135** is then constructed for insertion into laminator **40** as is schematically illustrated FIG. **10**. Book **135** comprising core **33**, including at least one layer of ink **36** and at least one layer of overlaminate film **38**, **39** is positioned between laminating plates which are preferably highly polished plates such as mirror finished stainless steel plates **90**, **92**. Book **135** also comprises first and second laminating pads **60**, **62** and first and second steel plates **70**, **72** as is discussed above in relation to FIG. **7**.

When book **135** is positioned between upper and lower platens **42**, **44** of laminator **40** as shown in FIG. **10**, the laminator is closed and a heat cycle in the range of 175° F. to 300° F., and most preferably in the range of 180° F. to 275° F., is applied to book **135** for a period of 10 to 25 minutes with a ram pressure that varies depending upon sheet size or the ram size of the laminator **40**, but which is typically approximately 1000 p.s.i. with an 18 inch diameter ram. The laminator **40** is then caused to execute a chill cycle, preferably with a corresponding increase in ram pressure. For example, the chill temperature may be in the range of 40° F. to 65° F. and last for a period of 10 to 25 minutes. A ram pressure increase of approximately 25% over the pressure used for the heat cycle has been found to be most preferable.

Subsequent to the above described second lamination cycle as illustrated in FIG. **10**, a sheet of plastic card stock is provided which comprises at least core **33** with at least one surface **34**, **35** thereof covered by a layer of ink **36**, and with at least one surface **34**, **35** thereof covered by a layer of overlaminate film **38**, **39**. Preferably plastic card stock manufactured in accordance with the present invention comprises core **33** covered on both surfaces **34**, **35** with a layer of ink **36** which is positioned between layers of overlaminate film **38**, **39**, all of which has been laminated together as described. One or more cards **10** then may be cut from the resulting plastic card stock and card **10** will have a thickness in the range of 0.028 inches to 0.032 inches with variation in overall thickness across the surfaces **12**, **14** thereof being no greater than approximately 0.0005 inches. The one or more cards **10** can thus be said to have a surface smoothness of approximately 0.0005 inches or better. Thus, a card **10** manufactured in accordance with the present invention includes at least one surface **12**, **14** at preferably both surfaces **12**, **14** that are sufficiently smooth and regular to receive dye sublimation printing.

Those skilled in the art will recognize that the foregoing description has set forth the preferred embodiment of the invention in particular detail and it must be understood that numerous modifications, substitutions, and changes may be undertaken without departing from the true spirit and scope of the present invention as defined by the ensuing claims.

What is claimed is:

1. A process for incorporating at least one electronic element in the manufacture of a plastic card, comprising the steps of:

(a) providing first and second plastic core sheets;

(b) positioning said at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a core, said plastic core sheets defining a pair of inner and outer surfaces of said core;

(c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:

(i) heating said core for a first period of time;

(ii) applying a first pressure to said core for a second period of time such that said at least one electronic element is encapsulated by said core;

(iii) cooling said core while applying a second pressure to said core,

(d) applying a layer of overlaminate film to at least one of said outer surfaces of said core.

2. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said laminator apparatus has first and second laminating plates, at least one of said first and second laminating plates having a matte finish for creating a textured surface on at least one of said outer surfaces of said core.

3. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **2**, wherein each of said first and second laminating plates has a matte finish for creating said textured surface on both of said outer surfaces of said core.

4. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said first and second plastic core sheets are made from a material selected from the group consisting of polyvinyl chloride, polyester, and acrylonitrile-butadiene-styrene, each of said sheets having a thickness in the range of 0.007 to 0.024 inch.

5. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **4**, wherein said first and second plastic core sheets have a thickness of approximately 0.0125 inch.

6. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said second pressure is greater than said first pressure.

7. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in

claim **6**, wherein said second pressure is at least approximately 25% greater than said first pressure.

8. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said core is heated in step (c)(i) to a temperature in the range of 275° F. to 400° F. and said first period of time is at least five (5) minutes.

9. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said first pressure is approximately 1000 p.s.i. and said second period of time is at least 10 minutes.

10. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said step (d) of applying a layer of overlaminate film comprises the further steps of:

(a) positioning an overlaminate film on at least one surface of said core;

(b) subjecting said core to a second heat and pressure cycle comprising the steps of:

(i) heating said core to a temperature between approximately 175° F. to 300° F. for approximately 10 to 25 minutes;

(ii) applying approximately 1000 p.s.i. pressure to said core, and

(iii) cooling said core to a temperature in the range of approximately 40° F. to 65° F. for approximately 10 to 25 minutes.

11. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said at least one electronic element is a micro-chip and an associated wire antenna.

12. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said at least one electronic element is a micro-chip and an associated circuit board antenna.

13. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said at least one electronic element is a read/write integrated chip and an associated antenna.

14. A plastic card constructed in accordance with claim **1**.

15. A hot lamination process for the manufacture of plastic cards, said process comprising the steps of:

(a) providing first and second plastic core sheets;

(b) positioning at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a layered core;

(c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:

(i) heating said core in said laminator, in the presence of a minimal first ram pressure, to a temperature which causes controlled flow of said plastic which makes up said first and second plastic core sheets;

(ii) applying a second pressure uniformly across said core for encapsulating said at least one electronic element within said controlled flow plastic;

(iii) subsequently cooling said core in conjunction with the concurrent application of a third pressure uniformly across said core, said core including and upper and lower surfaces.

16. The method as recited in claim **15** wherein said first and second core layers are devoid of any appreciable cutouts.

* * * * *

EXHIBIT 3

IN THE UNITED STATES DISTRICT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK

LEIGHTON TECHNOLOGIES, :
:
Plaintiffs, :
:
vs. : No. 04-CV-02496
:
:
OBERTHUR CARD SYSTEMS, S.A., :
OBERTHUR CARD SYSTEMS OF :
AMERICA CORPORATION, :
:
Defendants. :

--oOo--

VIDEOTAPE DEPOSITION OF

KEN THOMPSON

VOLUME I

May 4, 2006

REPORTED BY: KENNETH T. BRILL, RPR, CSR 12797

ELLEN GRAUER COURT REPORTING CO. LLC
126 East 56th Street, Fifth Floor
New York, New York 10022
212-750-6434
REF: 80728

THOMPSON

A. Yes.

Q. How did that come about?

A. As I recall, prior to -- prior to myself issuing a purchase order to Keith Leighton on a consultant basis, we flew him from Ohio to San Jose to discuss with myself and Jean-Marc Delbecq the work efforts we were looking for and the thing we were trying to accomplish.

Q. All right. Well, let me go back a step further, if I may.

A. Okay.

Q. What -- how did Mr. Leighton and Indala happen to get together?

A. I think Mr. Leighton, as I recall, Jean-Marc Delbecq had been at a customer sites or at equipment manufacturer sites, or material supplier sites sometime in late 1994, early 1995, and he had made acquaintances or relationships with some of those people.

And around that time I had also told Mr. Delbecq that in order to complete this particular project schedule we had, that I would like to have some experienced lamination credit card manufacturing person to assist us.

THOMPSON

So he had in his mind that -- that we were searching for someone, and I believe someone gave him Keith Leighton's name. I'm not sure if he met Keith Leighton then, or if he was just recommended by someone.

So as far as I recall, Jean-Marc Delbecq, through a referral to someone else, had identified Mr. Keith Leighton as a potential candidate to help us out.

Q. You -- you referred to a project schedule. What -- what does that refer to?

A. As I said before, we had -- we were selling at least two laminated card products, APC-161, and AVC-131, and we were trying to develop another -- a new lamination product, which had a hundred percent flat surface, which we were going to call AVC-132.

And we had significant customer pull and demand for a product like that; and our competition didn't. And we wanted to be the first on the market with a product like that. And our sales people had been in discussions with Microsoft. And Microsoft had requested products like this, and I believe our sales people committed to delivering the product

THOMPSON

was me that was hiring him.

Q. And what -- what exactly were you looking for Mr. Leighton to contribute to Indala?

A. In general, overall, I would say I was looking for him to contribute experience, knowledge and processes and procedures when it comes to laminating cards and producing cards. There is more processes than just the lamination. There is the printing. There is the cutting. There is a punching of the cards. There is a handling of the cards.

And I -- no one in our facility had experience in high volume manufacturing of cards. We were not comfortable using our supplier Caulastics to -- to really teach us a lot of that, because we were sort of going to be taking business away from them, so to speak.

So in particular, I was looking for an experienced person in the card lamination -- or card manufacturing arena to give us really good insights on things to improve our operations, our processes, our materials, our toolings, et cetera.

Q. Were you looking for help in designing the structure of the card?

EXHIBIT 4

IN THE UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

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LEIGHTON TECHNOLOGIES, LLC,)
plaintiff,)
vs.) Case No.
) 04Civ02496(CM)(LMS)
OBERTHUR CARD SYSTEMS, S.A.,)
defendants.)

\- - - - -

Videotaped deposition of JEAN-MARC DELBECQ, a witness herein, called by the defendant as if upon direct examination, and taken before David J. Collier, RPR, Notary Public within and for the State of Ohio, pursuant to subpoena and pursuant to the further stipulations of counsel herein contained, on Friday, the 3rd day of February, 2006 at 8:57 a.m., at the offices of Indala Corporation, 6850B Santa Teresa Boulevard, City of San Jose, State of California.

Q Did there come a time when you were -- I think the -- satisfied with the process I think was the word I used.
A No. No.
Q And why were you dissatisfied?
A Because we could not make it come out exactly right every time.
Q What could you not make come out right every time?
A The surface. We could not make that a best for printing surface 100 percent of the time.
Q You had a yield problem?
A Yes.
Q And what kind of yield were you getting for good surfaces, surfaces adequate to print on?
A I don't remember. I don't recall. It was -- it was not satisfactory.
Q Okay.
A We were losing money.
MR. B. JACOBS: That's not satisfactory.
THE WITNESS: Yeah.
Q But you were --
A We were throwing away parts, basically.
Q You were throwing away parts, but the parts

that were good you would sell?
A Yes. Yes. We sold thousands of them.
Q When was this period when you were use -- did this card that you just now described in Exhibit 2009 have a name, model number?
A I think it was referred to as the 131 card, and it had a prefix, which was AVC. AVC, I believe, was Advantage Vinyl Card.
Q You mentioned that you partnered with another company to make these cards.
A Yes.
Q What company was that?
A A company called Caulastics.
Q At what period did you start making the AVC-131 card?
A I believe that that was in 2004 also.
Q 2004?
A I'm sorry. 1994.
Q So you started making the AVC-131 in 1994?
A I think so.
Q Was this AVC-131 made before you met Mr. Leighton?
A Yes.
Q Was the die -- the disk tag made before you met Mr. Leighton?

EXHIBIT 5

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF NEW YORK

LEIGHTON TECHNOLOGIES, :
Plaintiffs, :
vs. : No. 04-CV-02496
OBERTHUR CARD SYSTEMS, S.A., OBERTHUR CARD SYSTEMS OF AMERICA CORPORATION, :
Defendants. :

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VIDEOTAPE DEPOSITION OF
KEN THOMPSON
VOLUME I

May 4, 2006

REPORTED BY: KENNETH T. BRILL, RPR, CSR 12797

ELLEN GRAUER COURT REPORTING CO. LLC
126 East 56th Street, Fifth Floor
New York, New York 10022
212-750-6434
REF: 80728

A. I can -- I can say I honestly do not know for sure, but I do know for sure that the results that we were getting were never as good as we'd like them to be. And there -- I believe the Jean-Marc, Tony Brett and Kiet were trying many different pressures, temperatures, times, et cetera, to -- to see if they could find a better parameters.

Q. Did there come a time when you started making the AVC-132s on a press other than the manual press?

A. Yes.

Q. And when was that?

A. It was shortly after we commissioned the press, which was late November, December, early January timeframe. I don't recall.

Q. When you say commissioned the press, you're talking about the B^{n}rkle press?

A. The B^{n}rkle press --

Q. To which --

A. The B^{n}rkle twin stack lamination press.

Q. Okay. And you started making these AVC-132 cards on the B^{n}rkle press before the date Mr. Leighton arrived at Indala?

A. Yes. We were developing the process,

trying to develop the product during that time.

Q. Now, did the process or the product structure -- let me rephrase the question.

Was the structure of the product any different when you were -- started using the B^{n}rkle press than what you've drawn on Exhibit 2,664?

A. The structure, as I recall, was -- was basically the same.

Q. When you say basically, can you recall any differences?

A. I can't recall any differences.

Q. Was the lamination cycle that you used on the B^{n}rkle press the same as you have drawn in Exhibit 2,665?

A. It was similar. So this was our starting point. We used the parameters, general parameters on the PHI press as a starting point for our lamination experiments on the B^{n}rkle.

Q. Now, we've -- we've talked about this B^{n}rkle press. What kind of press was the B^{n}rkle press?

A. The B^{n}rkle press was a -- what they call a twin stack press. So it had a separate hot press and a separate cold press. And it was also -- had,

EXHIBIT 6

IN THE UNITED STATES DISTRICT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK

LEIGHTON TECHNOLOGIES, :
Plaintiffs, :
vs. : No. 04-CV-02496
OBERTHUR CARD SYSTEMS, S.A., :
OBERTHUR CARD SYSTEMS OF :
AMERICA CORPORATION, :
Defendants. :

--oOo--

VIDEOTAPE DEPOSITION OF

KEN THOMPSON

VOLUME I

May 4, 2006

REPORTED BY: KENNETH T. BRILL, RPR, CSR 12797

ELLEN GRAUER COURT REPORTING CO. LLC
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A. The B^{n}rkle press was a -- what they call a twin stack press. So it had a separate hot press and a separate cold press. And it was also -- had,

THOMPSON

if you will call automation, to where you load cassettes and books for cards onto a stage.

And then when the cycles of the press were such, they would automatically push the cassettes and the materials from a number one, a staging stage, a loading stage, to a second one, a heating cycle, heating press. And the third one, a cold press. And the fourth being an exhaust. So it would automatically move the materials through the machine.

So that's the type of press it was. It was an old PC board press when it was purchased, from what I understand. And I don't recall where this used press was purchased from, but I understand it was used to make PC boards, multi layer PC boards.

Q. Was -- did the Bürkle press have weight compensation?

A. The Bürkle press had a weight compensation on the hot side. And the weight compensation, as I recall, was -- it was hydraulic -- or pneumatic, I believe it was pneumatic cylinder, so air cylinders, and had some chains attached to the platens, and for equal pressure, as I recall, this was a feature, or

EXHIBIT 7

IN THE UNITED STATES DISTRICT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK

LEIGHTON TECHNOLOGIES, :
Plaintiffs, :
vs. : No. 04-CV-02496
OBERTHUR CARD SYSTEMS, S.A., :
OBERTHUR CARD SYSTEMS OF :
AMERICA CORPORATION, :
Defendants. :

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VIDEOTAPE DEPOSITION OF

KEN THOMPSON

VOLUME I

May 4, 2006

REPORTED BY: KENNETH T. BRILL, RPR, CSR 12797

ELLEN GRAUER COURT REPORTING CO. LLC
126 East 56th Street, Fifth Floor
New York, New York 10022
212-750-6434
REF: 80728

quality, reliability improvements. Went on to develop -- or to work with our advanced manufacturing technology group and developed --

Q. When was that?

A. This was 1996 -- I'm sorry, 1984-'85 timeframe, I believe. And from 1984-'85-'86 timeframe until 1992, I was working with our advanced manufacturing technology group developing advanced IC packaging and interconnects for higher density electronics industry.

And then in 1992, took over as their technical operations manager for one of our radio factories, two-way radio factories, where I had 40 or 50 engineers and technicians and production personnel working for me, building two-way radio products.

Q. And from there you went to Motorola Indala?

A. That's correct.

Q. In San Jose?

A. That's correct. Motorola had purchased a company named Indala in 1983, I believe, and I began work there, I believe, October 1st, 1994.

Q. What was your job when you arrived at --

EXHIBIT 8

IN THE UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

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LEIGHTON TECHNOLOGIES, LLC,)
plaintiff,)
vs.) Case No.
) 04Civ02496(CM)(LMS)
OBERTHUR CARD SYSTEMS, S.A.,)
defendants.)

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you employed?
A I was.
Q And by whom?
A Motorola Indala.
Q For how long were you employed by Motorola Indala?
A I don't remember when I started. I remember when I quit, and I think it was about four and a half years.
Q So approximately from June of 1991 through --
A Yeah, approximately.
Q And you quit probably right before you took the Verifone job?
A A few weeks before, yes.
Q All right. Did you have more than one position at Motorola Indala?
A I did.
Q Could you briefly describe what your positions and responsibilities were.
A I started as a mechanical engineer, and my -- I was -- I was the only mechanical engineer in the company. I worked for Noel Eberhardt, and his function or his small group was called the Advanced Technology Group. We

were inventing, we were innovating, we were creating a fairly large number, wide variety, a lot of different products and manufacturing processes. I think what really differentiated that from a lot of engineering roles is that we designed the product and many times the method to produce the product, and -- and sometimes we designed the actual machines to produce the product.

Then after Motorola bought the company, Noel went to work on some even more advanced, far-reaching kinds of activities, and I took over managing the Advanced Technology Group and had a number of people reporting to me, designers, PCB people, mechanical engineer and some technicians.

Q So you -- basically you during your entire period were in the Advanced Technology Group; is that correct?

A Yes.

Q Prior to Motorola, for whom did you work, if anyone?

A I worked for Litton Applied Technology.

Q And what was your period of employment there?

EXHIBIT 9

IN THE UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

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LEIGHTON TECHNOLOGIES, LLC,)
plaintiff,)
vs.) Case No.
) 04Civ02496(CM)(LMS)
OBERTHUR CARD SYSTEMS, S.A.,)
defendants.)

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Videotaped deposition of KIET HUYNH, a witness herein, called by the defendant as if upon direct examination, and taken before David J. Collier, RPR, Notary Public within and for the State of Ohio, pursuant to subpoena and pursuant to the further stipulations of counsel herein contained, on Thursday, the 2nd day of February, 2006 at 8:29 a.m., at the offices of Indala Corporation, 6850B Santa Teresa Boulevard, City of San Jose, State of California.

A The time I remember is after I work with Jean-Marc maybe about a year, then we work on Berkel, and I think I meet him from that time --
Q Okay.
A -- but I don't remember what year.
Q What was your re -- in relationship to Mr. Leighton, what did Mr. Leighton do and what did you do?
A Mr. Leighton, I work with him, I -- I operate the Berkel machine. He checking when the final come out and he changing the time, the setup. Sometimes he talk with Mr. Ken Thompson to discuss about the lamination time readjust. So both of them talking and changing the setup, either one run the Berkel and put all the sheet on the cassette.
Q For how long did you work with Mr. Leighton?
A Probably three months, some or less. I don't remember.
Q When you were working on the manual press, did you keep a record of what you were doing?
A Not in a book. I write out on the sheet, lamination, the sheet, I put the coil laminate, I put the date, the temperature, the time, then

EXHIBIT 10

IN THE UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

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LEIGHTON TECHNOLOGIES, LLC,)
plaintiff,)
vs.) Case No.
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OBERTHUR CARD SYSTEMS, S.A.,)
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Q The actual --
A Daylight?
Q The daylight, yes.
A I don't remember.
Q Okay. Do you remember if the laminator was electric?
A What do you mean, "electric"?
Q Electric versus mechanical. Do you remember it was electric?
A Yes.
MR. LIEB: Objection to form.
A The manual --
MR. LIEB: Hold on. Objection to the form of the question.
A The manual.
Q Yes. And do you know what platens are?
A What is the platen?
Q Platens. Do you know -- does that word -- have you heard that word before?
A No, sir.
Q Did you have to close the laminator in order to heat up the books that had been placed in the laminator?
A The cassette, you mean?
Q Yes.

A Yes.
Q And you applied heat to the top and the bottom of the cassette; is that right?
A Correct.
Q And was pressure applied to the cassettes when you closed the plates?
A Yes.
Q Do you remember a process that was used where you used a single plastic core sheet to make identification cards --
MR. J. JACOBS: Objection.
Q -- at Indala? Do you remember that?
MR. J. JACOBS: Objection.
A On the small press. On the small press, the manual, small one, not on the Berkel.
Q And you -- in that process, you would cut a hole in the plastic core sheet; is that right?
A With that too. We do different way. With that and without that.
Q And you would -- you would place in that hole an antenna and a chip, right?
A Between the two sheet plastic, the coil and the chip.
Q And then you were using some type of gel that you would place; is that right?